CLAIMS:

1. A synthetic protein copolymer comprising at least one hydrophilic block and at least one hydrophobic block.

2. The protein copolymer of claim 1 having a first hydrophobic end block, a second hydrophobic end block, and a middle hydrophilic block.

3. The protein copolymer of claim 2 wherein said first and second end blocks are substantially identical.

4. The protein copolymer of claim 2 wherein the first end block comprises an amino acid sequence of $[VPAVG(IPAVG)_4]_n$ or $[(IPAVG)_4(VPAVG)]_n$; cross-referenced as SEQ ID NO:11 and SEQ ID NO:12.

5. The protein copolymer of claim 2 wherein the middle block comprises an amino acid sequence selected from the group consisting of: $[(VPGEG)\ (VPGVG)_4]_m$, $[(VPGVG)_4(VPGEG)]_m$, and $[(VPGVG)_2VPGEG(VPGVG)_2]_m$; cross-referenced as SEQ ID NO:14, SEQ ID NO:15, and SEQ ID NO:18.

6. The protein copolymer of claim 2 wherein the first end block comprises SEQ ID NO:11 or SEQ ID NO:12 and the middle block comprises SEQ ID NO:14, SEQ ID NO:15, or SEQ ID NO:18.

7. The protein copolymer of claim 6 wherein n is from about 5 to about 100 and wherein m is from about 10 to about 100.

8. The protein copolymer of claim 4 wherein n is about 16.

9. The protein copolymer of claim 2 wherein the middle block is selected from the group consisting of:

STRUCTURE	SEQ ID NO:
VPGVG $[VPGVG(VPGIGVPGVG)_2]_{19}$VPGVG;	21
VPGVG $[(VPGVG)_2VPGEG(VPGVG)_2]_{30}$VPGVG;	23
VPGVG $[(VPGVG)_2VPGEG(VPGVG)_2]_{38}$VPGVG;	24
VPGVG $[(VPGVG)_2VPGEG(VPGVG)_2]_{48}$VPGVG;	25
VPGVG $[VPGVG(VPNVG)_4]_{12}$VPGVG;	30
VPGVG $[(APGGVPGGAPGG)_2]_{23}$VPGVG;	33
VPGVG $[(APGGVPGGAPGG)_2]_{30}$VPGVG;	35
$[VPGVG(IPGVGVPGVG)_2]_{19}$;	38
$[VPGEG(VPGVG)_4]_{30}$;	41
$[VPGEG(VPGVG)_4]_{48}$;	42
$[(APGGVPGGAPGG)_2]_{22}$; and	43
$[(VPGMG)_5]_x$, wherein x is from about 10 to about 100.	63

10. The protein copolymer of claim 9 wherein the first end block comprises an amino acid sequence of $[VPAVG(IPAVG)_4]_n$ or $[(IPAVG)_4(VPAVG)]_n$; cross-referenced as SEQ ID NO:11 and SEQ ID NO:12.

11. The protein copolymer of claim 1 capable of elongation up to about 14 times its initial length.

12. A film comprising the protein copolymer of claim 2.

13. The film of claim 12 comprising a plurality of layers.

14. The multi-layered film of claim 13 comprising a first layer and a second layer, wherein the first layer derives from a first polymer exposed to a first solvent, and the second layer derives from a second polymer exposed to a second solvent, thereby creating a film having a desired mechanical property.

15. The multi-layered film of claim 14 wherein the first polymer and the second polymer are substantially identical.

16. The multi-layered film of claim 14 wherein the first solvent enhances film elasticity and the second solvent enhances film plasticity.

17. The multi-layered film of any of claims 14 wherein the first solvent is water and the second solvent is trifluoroethanol.

18. The protein copolymer of claim 1 in gel form.

19. The protein copolymer of claim 1 in the form of a fiber or fiber network.

20. The fiber network of claim 19 comprising a first fiber and a second fiber, wherein the first fiber derives from a polymer exposed to a first solvent and the second fiber derives from a polymer exposed to a second solvent.

21. A method of generating a medical implant comprising the step of including the fiber of claim 19 in the implant.

22. A method for producing a plastic elastic protein copolymer comprising the steps of

    a. providing a first block of nucleic acid sequence, wherein said first block encodes a hydrophilic protein;

    b. providing a second block of nucleic acid sequence, wherein said second block encodes a hydrophobic protein;

c. synthesizing a nucleic acid molecule comprising said first and second blocks; and

d. expressing said nucleic acid molecule to produce said protein copolymer.

23. The method of claim 22 further comprising solubilizing said protein copolymer in a solvent, thereby creating a solution, and bringing said solution to a temperature to cause said copolymer to agglomerate to form a non-covalently crosslinked mass.

24. The method of claim 22 further comprising covalently crosslinking said polymer.

25. A method of manufacture of a stent, embolization coil, vascular graft, or other implanted biomedical device comprising the method of claim 23 and further comprising the steps of

e. including a drug or biological agent in the solvent, thereby making a mixture with said copolymer; and

f. applying said mixture to said stent, embolization coil, vascular graft, or other implanted biomedical device.

26. A nucleic acid sequence comprising S1 (SEQ ID NO:45), S2 (SEQ ID NO:46), S3 (SEQ ID NO:47), or S-adaptor (SEQ ID NO:48).

27. The method of claim 22 wherein said first block or said second block of nucleic acid sequence comprise one or more sequences of claim 26.

28. A medical device, cell, tissue, or organ further comprising the film of claim 12.

29. The film of claim 12 further comprising a synthetic or natural fiber.

30. The film of claim 12 further comprising a drug or biologically active compound.

31. The fiber or fiber network of claim 19 having a selected shape of a planar sheet or a tubular conduit.

32. A medical device, cell, tissue, or organ at least partially covered or reinforced with the fiber or fiber network of claim 19.

33. The protein copolymer of claim 2 in the form of a microparticle.

34. The microparticle protein copolymer of claim 33 having a spherical shape and a diameter of up to about 0.4 millimeters.

35. The protein copolymer of claim 1 in the form of a biocompatible coating on a device.

36. The coating of claim 35 wherein said device is a medical implant.

37. The protein copolymer of claim 2 wherein said copolymer has a transition temperature in a solvent that is an inverse transition temperature.

38. The protein copolymer of claim 37 having a transition temperature of from about 4°C to about 40°C.

39. The protein copolymer of claim 37 having a transition temperature of from about 16°C to about 25°C.

40. The protein copolymer of claim 37 having a transition temperature of from about 32°C to about 37°C.

41. A medical implant comprising the protein copolymer of claim 1.

42. A drug delivery material comprising the protein copolymer of claim 1.

43. A wound dressing comprising the protein copolymer of claim 1.

44. A cell, tissue, or organ partially or completely encapsulated by the protein copolymer of claim 1.

45. The cell of claim 44 wherein the cell is a pancreatic islet cell.

46. The protein copolymer of claim 1 which is non-covalently crosslinked.

47. The protein copolymer of claim 1 which is covalently crosslinked.

48. A complex comprising a first and a second protein copolymer of claim 1 wherein the first and second copolymers are non-covalently crosslinked.

49. The complex of claim 48 wherein the first and second protein copolymers are substantially identical.

50. A complex comprising a first and a second protein copolymer of claim 1 wherein the first and second copolymers are covalently crosslinked.

51. The complex of claim 50 wherein the first and second protein copolymers are substantially identical.

52. The protein copolymer of claim 1 comprising a chemical substituent.

53. The protein copolymer of claim 52 wherein the substituent is an amino acid capable of facilitating crosslinking or derivatization.

54. The protein copolymer of claim 53 wherein the amino acid is lysine or glutamine.

55. The protein copolymer of claim 1 comprising a functional site capable of facilitating chemical derivitization for a covalent crosslinking reaction.

56. The protein copolymer of claim 1 comprising a photocrosslinkable acrylate group capable of forming stable crosslinks upon an interaction with an appropriate initiator and light.

57. The protein copolymer of claim 1 comprising a functional site capable of serving as a binding site.

58. The protein copolymer of claim 57 wherein the binding site is an enzyme binding site.

59. The protein copolymer of claim 57 wherein the functional site comprises a selected protease site capable of allowing degradation of said protein copolymer.

60. The protein copolymer of claim 1 comprising a metal or other inorganic ion nucleation site.

61. The protein copolymer of claim 1 comprising an adhesion molecule recognition site or enzyme active site.

62. The protein copolymer of claim 1 further comprising an agent wherein the agent is a drug or biologically active molecule or biomacromolecule.

63. The protein copolymer and agent of claim 62 wherein said agent is covalently bound or non-covalently bound to said copolymer.

64. The protein copolymer of claim 1 further comprising a selected molecule wherein the selected molecule is a saccharide, oligosaccharide, polysaccharide, glycopolymer, ionic synthetic polymer, non-ionic synthetic polymer, or other organic molecule.

65. The protein copolymer of claim 64 wherein the selected molecule is covalently bound to said copolymer.

66. The protein copolymer of claim 64 wherein the selected molecule is non-covalently bound to said copolymer.

67. The protein copolymer of claim 1 further comprising a synthetic or natural compound capable of effecting an alteration of a surface property of said copolymer.

68. The method of claim 25 wherein the drug is sirolimus.

69. The method of claim 25 wherein the drug is amphiphilic.

70. The method of claim 25 wherein the mixture is in the form of a gel, film, or fiber.

71. A method of generating a medical implant having a selected mechanical property comprising applying the fiber of claim 19 to the implant.

72. The method of claim 71 wherein the implant comprises skin, vein, artery, ureter, bladder, esophagus, intestine, stomach, heart valve, heart muscle, or tendon.

73. A method of generating a wound dressing having a selected mechanical property and having a selected shape, comprising forming the fiber of claim 19 into the selected shape.

74. A method of generating a medical implant comprising applying the film of claim 12 to the implant.

75. The method of claim 74 wherein the implant comprises skin, vein, artery, ureter, bladder, esophagus, intestine, stomach, heart valve, heart muscle, or tendon.

76. A method of generating a wound dressing having a selected mechanical property and having a selected shape, comprising forming the film of claim 12 into the selected shape.